MODERN PRACTICE
PHOTOGRAPHY.

R. W. THOMAS, F.C.S.

THE

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OF

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BY

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"I have said, and I abide by it," cries Voltaire, "that the fault of most books is their being too long."

"A writer who has reason on his side will always be concise."

BISHOP HORNE.

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INTRODUCTORY SKETCH.

PROBABLY no modern science or art can boast of so many roads to success, as that which owns itself the servant of the sun. It is easy to understand why this should be so, for all things, animate and inanimate, are affected by the sun, which at the same moment gives us both light and life, and is a fertile source of chemical decomposition. It becomes, therefore, evident that the slightest investigation, the mere cursory examination of the many valuable storehouses of knowledge, is sufficient for developing that which at first sight appears new, but which, in reality, is only proof of the statement above made, that all bodies are more or less acted upon, and changed by the agency of light.

Hence the innumerable processes in photography, which spring up daily, giving constant occupation and food to the experimentalist, engaging earnestly his attention, and so absorbing his interest by a success more or less certain, as to make the pursuit of this art, probably the most fascinating, the most exciting, and the most productive of results of any followed by the intelligent and intellectual classes of the present day.

If the above paragraph has been carefully read, it

will be easily seen that as there are many roads pointing to the same end, so, in proportion to their number, will be found the difficulty in selecting that path which the novice will gladly seek, as leading direct to a successful practice of the art in question. It will be my endeavor to point out that road, and in doing so, I would not for a moment disparage the opinions of others, but merely show, without turning either to the right or to the left hand, how perfect results may be obtained; but, in doing this, I feel that brevity must take the place of a system more prolix, and to some minds, more agreeable. Let, if you will, these pages be a primer—a first lesson on one of many processes; yet, the object I have in view is to put before those who require instruction on the subject of photography, a pamphlet which shall enable them at once, not only to succeed, but, with a little practice, to rival those who stand foremost as the most successful votaries of this engaging art.

Now it would hardly do, from this preamble, to descend suddenly to a process, without feeling sure that the reader, who, perchance, may be altogether a novice, has some knowledge of the principles on which the art of photography is based; a writer must have no slight acquaintance with his subject who can make a complex matter clear and intelligible to the understanding of his reader by the use of a few paragraphs only. I despair of doing this to my own satisfaction, but, nevertheless, such an attempt has to be made, and in making it my aim shall be rather to excite the interest and attention of a student, so as to compel him to turn for fuller information on the various heads of the subject under notice, which may

be found by making reference to works on optics and chemistry.

The first question, what is light? naturally suggests itself. In answer, this much is known: light comes to us through the medium of our atmosphere, pure and white, yet it is easily decomposed; its rays, analyzed and divided by means of the prism, show seven principal colors, each color has its own property, and specifically its own chemical action; it is with this latter fact that we have to do, our whole practice of photography depending on the actinism of the violet color and the invisible rays beyond, as shown by chemical experiment to exist in the spectrum; the red and yellow rays at the opposite end, although most luminous, affect only in a slight degree, chemical bodies. It becomes, therefore, evident, bearing this fact in mind, that photographic lenses must be constructed, not possessing the power of giving the most luminous and, consequently, the most brilliant image only, on a ground-glass, placed at a point termed the focus of a lens, but the visual and chemical foci must be blended, so to speak; this, the skilful optician effects by combining lenses of various curves and densities, with a view of obtaining at the same focus two distinct powers, light and actinism, each, under ordinary conditions, being refracted at different distances. I need only remark that the problem has been well and satisfactorily worked out by our great opticians, who have also given to photographers a variety of useful combinations of lenses, not dreamt of in the earlier days of their art.

I have shown already that light produces chemi-

cal change in bodies, but before proceeding with my explanation in this direction, as the picture to be formed is a monochrome made up of light and shade only, it will be as well to feel sure that the novice clearly understands what would be the effect of throwing a shadow by any means whatever on to a piece of white paper, prepared in such a manner as to be visibly affected by exposure to diffused light, or to the sun's rays; the effect of course will be to produce a modification of the action of light on the parts so shaded, and in proportion to the intensity of the shadow, so will be the want of intensity in the action of light on the prepared paper. Now, in order fully to realize this in a manner evident to the senses, we must make use of paper, prepared with chloride of silver in the dark; the albumenized paper of commerce, when floated on a solution of nitrate of silver, becomes such a paper; it must be then carefully dried either in the dark or in yellow light; a slip of this paper exposed to white light, either natural or artificial, immediately changes color, the silver being reduced, and according to the time of exposure so will be the intensity of the color, changing from light brown to bronze.

I have before stated that the shadow of any object thrown upon this paper during its exposure to light, will, according to its intensity, protect the prepared surface, and should the hand, with its fingers extended and held between the paper and the source of light, be the object chosen, a representation of the form of the fingers on the sensitive paper will be the result. In this we find the key to the formation of a photographic picture; bearing it in mind, it is easy to understand that which follows. Now the lens and

camera are the instruments used by the photographer for the production of the image of any object capable of being represented by light and shade. It is, I think, fair to presume that a person wishing to follow the art of photography will have acquainted himself with at least this fact, that a lens fitted to the outside of a dark box, so arranged that one part shall slide within the other, does, at a certain point called a focus, which varies with the distance of the lens from the object, produce a representation on a ground-glass of any object at which the lens may be pointed. If the ground-glass be made movable, and a slide with a shutter properly arranged, containing a plate sensitive to light, be made to occupy exactly the same position as that occupied by the ground-glass, it follows that a representation of the object will fall upon the sensitive plate placed as described. This is the first step in the process by which photographic views, portraits, &c., are produced. I will now proceed to speak of the chemicals used for preparing the plate that has been, as above shown, placed in the slide occupying the position of the ground-glass. I must, however, pause for a moment to explain some distinct properties possessed by different chemical preparations sensitive to light. I have already shown how chloride of silver is affected, the change which takes place being visible, and, so to speak, accumulative: this change is, however, slow, and cannot be accelerated or developed to any further extent when the light has been withdrawn. It is, therefore, evident that such a process, although excellent for the production of the positive photograph on paper, is not suited for the preparation of a highly sensitive

plate to be placed in the camera for the purpose of portraiture. We find in the iodide and bromide of silver a peculiar property, viz., that of receiving an impression rapidly, which, although at first invisible, is capable of being further developed and intensified. It is with these chemicals that the sensitive plate is prepared. The most convenient vehicle for holding the salts in solution, capable of being easily transformed into the iodide and bromide of silver, is collodion, to which I must now allude briefly.

Collodion is a solution of pyroxyline (gun-cotton) in ether and alcohol, which, when poured upon glass, sets readily, leaving a film, structureless, transparent, and porous; it, moreover, adheres perfectly to the glass. If a solution containing a salt of iodine and bromine be added to a solution of nitrate of silver, a precipitate of iodide and bromide of silver immediately takes place; it can, therefore, be easily understood, that if the same salts be dissolved in collodion, and the film, when properly set on the glass, placed in a bath of nitrate of silver, the insoluble salts, iodide and bromide of silver, are formed and retained in the body of the film, rendering that which was transparent, opaque and yellow. Such a film is more sensitive to light than any with which we are acquainted; a glass prepared with this sensitive film may therefore be, in the wet state, at once transferred to the dark slide and placed in the camera, where it occupies the position of the ground-glass; the lens being uncovered, a few seconds' exposure is sufficient to impress this highly sensitive plate with an invisible image.

At this stage it will be instructive to explain what

takes place when certain solutions are made use of for the purpose of developing the latent image with which the film has been impressed; and bearing in mind what has been said in the first part of this essay concerning the non-actinic quality of yellow light, it will be hardly necessary to remark, that the preparation of the sensitive plate and its subsequent development, must be performed by light passed through a yellow medium, such as glass stained of a proper color.

Proto-sulphate of iron is the deoxidizer now generally used for continuing that change which has been effected on the plate in the camera by light. On applying a solution of this salt, the image is seen to develop, and precisely in proportion to the light reflected from the various parts of the object copied, so will be the intensity or blackness of the parts of the plate thus acted upon. This first picture is termed a negative, the lights and shades, as seen in nature, being in it reversed; for instance, the sky of a landscape, as reflecting most light, would be black, and the dark-shaded parts of trees would be represented on the plate as parts much less opaque, shading off to a point at which the glass has been entirely protected by the deep shade of foliage; or a portrait may be taken as another illustration; in this case, the face would be more or less dark, the white shirt black, and dark clothes more or less light in the negative.

Now the development of this image, as I have shown, must take place in yellow light; it is evident, therefore, that all sensitive salts should be removed before viewing it by daylight, and thus the further action of white light is arrested. For this purpose it is only necessary to wash off the developing solu-

tions with water, and act upon the iodides and bromides by means of any solvent capable of removing these salts from the film; the cyanide of potassium performs this operation effectually; and, lastly, when the excess of cyanide has in its turn been removed by washing with water, the negative picture is completed, and may now be dried and varnished. When viewed by transmitted light, a perfect representation of the subject is seen, the lights and shades being reversed. Such a picture, although highly interesting, and beautiful in the extreme, would be considered useless as a work of art; moreover it is upon glass, consequently liable to injury. It is at this stage, therefore, that we avail ourselves of the paper process before alluded to, and the advantage of such a process for the production of the prints, or positive pictures, as they are called, is at once apparent.

The negative picture thus produced may be looked upon as a matrix for the production of any number of positives, the process is most simple, and if the reader comprehends that which has been already written, it becomes evident that light passing through the negative on to a sensitive paper, prepared as before described, will be admitted or intercepted in proportion to the resistance offered to its passage by the opaque or shaded parts of the negative, and the resulting positive on paper will be consequently the reverse of that on glass, the lights and shades being found now to occupy their correct positions. This end is brought about by merely placing the face of the negative in close contact with the surface of the sensitive paper, subjecting both to very slight pressure in a suitable frame, sufficient to prevent shifting

and to insure perfect and equal contact; they are now exposed, so placed, to the action of light for the proper time, this being ascertained by an occasional examination of the print during exposure.

As in the completion of a negative picture, the superfluous sensitive salts must be washed out; an agreeable tone is then imparted to the proof by immersion in a solution of chloride of gold, and the excess of chloride of silver removed by means of a proper solvent (hyposulphite of soda); the print is then freely washed in water, dried, and mounted.

The finished photograph is a marvel of science; it calls forth the admiration even of him who is little skilled in the technicalities of art, appealing as it does to a new sensation, that vibrates with a strange pleasure on viewing for the first time, a picture having reality in the perfection of its light and shade, the gradations produced being so delicate and subtle, as to set at defiance both the painter's brush and the graver's tool. In this consist the charm, the perfection, and the individuality of photographic art.

HOW TO MAKE THE NEGATIVE,

USING

COLLODION BROMO-IODIZED

FOR

IRON DEVELOPMENT.

1.—The edges of the glass should be ground all round, also slightly on the surface of the edges; this prevents contraction of the film, enabling it to resist the action of a heavy stream of water; mark one side in the corner with a diamond, and upon this side bestow the greatest care.

2.—To Clean the Glass if New.—Make a mixture of Spirits of wine and Solution of Ammonia, equal parts: render it as thick as cream with Tripoli; with a piece of cotton-wool kept for this purpose rub a small quantity over that side marked as described, wash well under a tap of water, and wipe dry with a piece of old linen, washed without soap, and kept scrupulously clean for this purpose. Plates should not, however, be cleaned in the operating room with the above mixture; the vapor of ammonia might prove injurious to the chemicals.—*Vide* also my paper on cleaning the plate.

3.—Now polish with an old white silk handkerchief; if this latter precaution be not taken, small particles of linen will be left upon the plate; these are perhaps only seen when draining off the collodion, they form nuclei and eddies, checking the collodion in its course; some of these minute fibres are washed off and contaminate the next picture. To all lovers of clean pictures my advice, therefore, is, having well dried the plate with old linen, lay it, clean side upwards, upon a few sheets of common glazed demy paper (not blotting), and rub it hard with the silk until sensibly warm; this has the double advantage of dispersing fibres and moisture, for all glass plates are slightly in a hygrometric condition. Double the silk rubber up to form a pad, and with this the glass must be firmly dusted down just before pouring on the collodion, which will then run most evenly; if the coated plate is now viewed by transmitted light not a speck or blemish will be seen upon it. When a plate, cleaned as above described, is breathed upon, the moisture does not evaporate slowly, but *flies off*. Do not be afraid of putting the glass into an electrical condition with the silk rubber; on this account objections have been raised to the use of silk; practically, however, I find it a most valuable auxiliary in this starting point of the process, the perfect manipulation of which makes an important difference in the value of the finished picture. What can be more unartistic and annoying to an educated eye than spots, patches, stars, and sky rockets, the forms and shapes of which rival, in numberless variety, a display of fireworks? Let us not, therefore, be contented with pictures, however good in other respects, presenting these deformities—so many blots on the photographic escutcheon.

INTENSIFYING SOLUTION.

Pyrogallic Acid . . .	6 grs.	
Glacial Acetic Acid . .	½ oz.	
Distilled Water . . .	6 ozs.	Mix.

A few drops of a 30-gr. solution of Nitrate of Silver, the quantity to be regulated according to the intensity required, to be added, at the moment of using, to as much of the Pyrogallic Solution as may be necessary.

INTENSIFYING SOLUTION.—(Another Form.)

No. 1.

Pyrogallic Acid . . .	8 grs.
Citric Acid	20 "
Distilled Water . . .	2 ozs.

No. 2.

Nitrate of Silver . . .	8 grs.
Distilled Water . . .	2 ozs.

Mix small quantities of the solutions Nos. 1 and 2 in equal portions, the moment before using.

The pyrogallic solution, made with good acetic acid, may be kept for a month or more in a cool place. Nevertheless, if the conditions of light and situation are unfavorable, I should prefer this solution just made. The iron solutions act best when freshly prepared.

It is supposed by some that a prolonged action of the iron developer produces fogginess; this may be the case when impure or improperly prepared collodion is used, but certainly not when this preparation is pure and of the proper quality.

Some operators are in the habit of flushing the plate with the iron solution, causing it to run off and carry with it all the silver on the plate. This practice cannot be too strongly condemned. A protest against it by a writer in the "American Journal of Photography," is made in such forcible language, that I give it in his own words, at the same time adding, as the result of my own observations, that no amount of silver used afterwards, compensates for the loss of that, which has been carelessly washed off by dashing on the developer. The silver retained on the plate, and present during the action of light upon it in the camera, imparts a peculiar quality to the developed picture. The writer referred to above, says:—

"The reckless style of manipulation seems to me to be the origin of a vicious style of developing, which with many has become a habit, and a practice which is sometimes defended. I allude to the dashing on the developer, and deluging the plate with it. Did it ever occur to those who develop in this way, that the developer was needed on the plate and not in the sink? that the silver which might have assisted to strengthen an image is swept away beyond reach? In my opinion, about half the re-developments and strengthenings might be omitted, except for this washing away of the life of pictures.

"The rule ought to be in treating a plate, not to spill a drop of collodion, developer, or fixing.' Some may fear fogging, or over development, by following such a system. But let such try the plan thoughtfully, and they will find their fears are groundless. Let them recall their ordinary rules, and the seeming difficulties vanish. If the developer is too active, add acid, or dilute.

"The chief item in my receipt for intense negatives is, Do not spill the developer."

I have heard it remarked by excellent operators, that unless the plate be flooded in the way described, the negative would be stained all over; such an evil can only be due to the imperfect quality of the collodion used, and my advice is, under such circumstances, to let it go the way of all worthless rubbish.

8.—When the image is sufficiently intense, wash freely with common filtered water; then pour on a saturated solution of Hyposulphite of Soda, which should immediately remove the iodide of silver: wash again well with water; allow as much as the plate will hold to soak in for at least a quarter of an hour, changing the water occasionally, to remove all traces of hyposulphite; lastly, wash the plate with a little distilled water, stand up to dry, and if required, varnish either with spirit or amber varnish.

The following solution is also very commonly used for fixing the negative:—

Cyanide of Potassium . .	½ oz.
Water	12 ozs.

REMARKS ON THE USE

OF

COLLODION IODIZED

FOR

PYROGALLIC DEVELOPMENT.

THE collodion for use with pyrogallic acid only, as the developer, is iodized, either with iodide of cadmium or iodide of potassium, but whatever iodide be used, no salt of bromine should be added to the collodion.

Formerly this was the only preparation used by photographers for the production of negatives, but now it has been superseded by the bromo-iodized collodion for iron development. Considerable intensity is easily obtained with this preparation; there is, however, always a danger of producing negatives too black and white, the contrasts being too violent; it is, however, still employed by some most skilful photographers, both professional and amateur. The question is often asked, Which collodion do you recommend for general use? It will be best answered by giving a description of the properties of both a plain iodized collodion and one containing a bromide: the operator can then select for himself.

PLAIN IODIZED COLLODION.

Properties briefly stated:—

1.—Its special fitness for use with a pyrogallic acid developer, with which the maximum of intensity is obtainable.

2.—Its suitability also for use with an iron developer, with which a little more detail is obtained, and a modification of the intensity of the image.

BROMO-IODIZED COLLODION.

The characters of a Bromo-Iodized Collodion are marked and well-defined; they may be briefly stated:—

1.—Its special fitness for use with an iron developer, giving the maximum amount of half-tone obtainable.

2.—A decided decrease in the intensity of the image.

3.—A peculiar property of resisting solarization of those parts of the image strongly lighted, which enables the operator to expose his plate long enough to bring out details in deep shadow, without impairing the definition of those portions of the picture, first impressed on the plate.

It will be at once gathered from these remarks that a Bromo-Iodized Collodion gives the utmost amount of half-tone obtainable, when used with an iron developer. There is still a difference of opinion

among photographers as to the value of the two preparations; some prefer a plain Iodized Collodion, with an iron or pyrogallic developer, whilst the majority always use a Bromo-Iodized Collodion. I myself think that the latter preparation is decidedly best adapted for the production of that class of pictures, now generally considered to be the most pleasing and artistic. Bearing, however, in mind the character of each preparation, it is better to be provided with plain Iodized Collodion, which can be mixed in suitable proportions with that Bromo-Iodized, for the purpose of modifying the results.

It is only necessary to give the formula for Pyrogallic Acid developer, for the method of working and rules to be observed are precisely the same as those described in the preceding chapter.

PYROGALLIC SOLUTION.

Pyrogallic Acid . . .	6 grains.	
Glacial Acetic Acid . .	$\frac{1}{4}$ oz.	
Distilled Water . . .	6 ozs.	Mix.

In cases where it is desirable to add to the intensity of the negative, a few drops of a 30-grain solution of Nitrate of Silver may be mixed with the developing liquid towards the end of the development.

The Collodion Iodized with Cadmium retains its sensitiveness without change for years. The Collodion Iodized with Potassium undergoes a slow change when kept for some time Iodized; this property is much esteemed by professional photographers who require Collodion in various conditions of sensitiveness and intensity.

ATTENTION TO THE FOLLOWING RULES AND CAUTIONS WILL ASSIST THE OPERATOR IN THE PRODUCTION OF PERFECT PICTURES.

1.—Do not disturb the deposit which will occasionally be found at the bottom of the bottle containing the Collodion.

2.—Remove all particles of dried film from the neck of the bottle before pouring the Collodion on the plate.

3.—Never use damp clothes, leathers, or buffs, for giving the final polish to the plate; negatives with an indistinct and muddy surface are frequently produced from this cause.

4.—Let the film set properly before immersion in the Nitrate of Silver Bath; its condition can be ascertained by gently touching the lower part of the coated plate with the end of the finger.

5.—Never omit to pass a broad camel-hair brush over the plate just before pouring on the Collodion.

6.—Bear in mind that, as light is the producing agent, so will it prove a destructive one; not less than four folds of yellow calico should be used to obstruct white light; and in that case the aperture covered should be no larger than is necessary to admit sufficient light for working by. Examine occasionally the yellow calico; when this material is used to exclude white light, it becomes bleached by constant exposure. Do not trust alone to any colored

glass; no glass yet made is adi-actinic under all aspects of light and conditions of exposure.

7.—When the negative requires intensifying, carefully wash off all traces of the first developing solution before proceeding to intensify. This operation may be performed either before or after the Iodide is removed by fixing.

8.—Glass Baths are preferable to Porcelain, Ebonite, or Gutta-Percha Baths for solution of Nitrate of Silver.

9.—In using either Spirit or Amber Varnish, before pouring it off, keep the plate horizontal a few seconds—this gives time for soaking in, and prevents the formation of a dull surface arising from too thin a coating.

10.—Rub the lenses occasionally with a soft and clean wash leather; the rapidity of action is much influenced by the brightness of the lenses: their surfaces are constantly affected by moisture in the atmosphere, which, condensing, destroys the brilliancy of the image.

11.—The white blotting-paper used for some photographic purposes is not suitable for filtering solutions; that only should be employed which is made for this purpose, and is sold under the name of filtering-paper.

12.—Hyposulphite of Soda.—A great deal of rubbish is sold under the name of this salt; as a test of its quality, 1½ drachms should entirely dissolve in one drachm of water, and this solution should dissolve rather more than 4½ grains of Iodide of Silver.

13.—Chemicals.—The purity of photographic chemicals cannot be too strongly urged—the cheapest are not always the most economical. The commercial

preparations are generally not to be depended upon, as these, though perhaps unadulterated, are, strictly speaking, not chemically pure. It is best to procure them from well-known chemists, who understand the purpose for which they are intended, and make the preparation of these substances peculiarly a branch of their business.

14.—Never leave chemical solutions exposed in dishes; when done with, pour them back into glass-stoppered bottles and decant for use from any deposit, or filter if necessary.

15.—In all photographic processes it is absolutely necessary to be chemically clean; and this sometimes is not easy: as a rule, never be satisfied with cleanly appearances only, but take such measures as shall insure the absence of all the extraneous matter in preparing the solutions, cleaning the glasses, dishes, &c.

16.—All stains on the hands, linen, &c., may be removed by means of Cyanogen Soap or Cyanide of Potassium, which should be applied without water at first, then thoroughly washed off. To assist the operation, the hands may be now gently rubbed with a fine piece of pumice-stone, when the stains quickly disappear.

NOTES.

1.—When working with a double lens in the open air, or in situations where there is much light, the full aperture of the lens being used, it is necessary to provide against the action of diffused general light which, under these circumstances, enters the lens, destroying the brilliancy and intensity of the image —in fact, acts chemically over the plate; thus giving a muddy, flat, or otherwise imperfect picture—an appearance corresponding to the fog produced by some collodions. This general action of diffused light, during the exposure of the plate in the camera, interferes subsequently with a prolonged or even necessary development. My attention was drawn more particularly to this fact, from the circumstance of having to make alterations in my glass room for the purpose of obtaining twice the amount of light; when completed, I was quite unable to take a picture, simply because the extra light introduced, although a north light, interfered with the darkness necessary for the production of clean and vigorous pictures in the camera. The remedy for this is simple: I screw on to the front of my camera a sliding dark box, open at the end. I can, by this means, regulate the amount of protection according to circumstances, viz., from twelve to twenty-four inches; brilliant and intense negatives are thus obtained. Now remove the protector, and the reverse is evident; the picture is flat, faint, shows a want of detail and a general tendency to blacken over under the influence of the

developer. It is obvious that this arrangement is more particularly useful when double lenses with large aperture are used.

2.—Under all circumstances, throw a large black cloth over the slide when placed in position, and if the camera has a sliding front, let the black cloth hang a few inches over the front of the camera, before drawing up the shutter; now put the left hand underneath the cloth, place this on the top of the slide to keep it in place, and with the right hand outside feel for the leather tongue; pull up the cloth and shutter together; the cloth should not be removed until the slide has again been closed; this sufficiently indicates the necessity for preventing ever so slight a ray of light attacking the plate during the exposure. First-rate pictures cannot be obtained in the open air, unless this precaution be taken.

3.—Use as little light as possible in the dark room; the quantity must be regulated by the aspect of the window through which the yellow light is admitted. A candle would entirely spoil a collodion plate, unless protected by means of a yellow calico shade.

4.—Condition of collodion best suited for different purposes:—For portraiture with a double lens, mix the collodion twelve or twenty-four hours before it is required for use; the picture thus obtained is more intense than when collodion recently mixed is used. For works of art and still objects, &c., collodion a week old is best; and for landscapes, a greater general intensity and sufficient rapidity of action are obtained, when the collodion has been mixed a fortnight. For black and white objects, *i. e.*, engravings, &c., use collodion a month old.

5.—Collodion in hot weather may become too thick to use conveniently; it should then be slightly diluted with a mixture made of two parts of ether and one part of absolute alcohol of known purity, and well shaken.

6.—THE CAMERA DESCRIBED.—A good and well-made camera is more or less useful in proportion to the skill bestowed on its construction. The best seasoned wood and most accurate measurements are necessary; moreover, every part must be easily under command. A camera should be made on the most simple principles; all unnecessary complication of screws and joints avoided. Let *strength*, *simplicity*, and *correct* workmanship be the primary consideration. For the collodion process, I prefer a plain sliding trunk camera, half the bottom board hinged to turn up—thus forming a box in which to pack and carry some of the necessary apparatus, and a stout handle screwed to the top. The camera should also have a sliding front, by means of which the lens is made to move vertically, for the purpose of cutting off foreground—an arrangement at times desirable when other portions of the picture are of more importance. The piece of ground-glass upon which the image falls must be finely ground plate; and if an upset or smash occurs, take care, in replacing, that the ground side faces the *inside* of the camera. Double slides are most convenient for the dry plate processes; these slides are hinged and open in the centre; the sensitive plates are then placed face downwards, and shut up back to back, with two pieces of blotting-paper or a diaphragm between them. The slide for wet collodion is, of course, constructed on a different principle; it contains a frame to hold the collodionized glass, which rests upon

silver wires inserted diagonally at each corner; the loose frame is hollowed out to prevent the wood coming in contact with the wet silvered plate. A very slight imperfection in the collodion slide, sufficient to admit an infinitesimal ray of light, would have a damaging effect upon the beauty and perfection of the negative picture.

Expanding or bellows cameras are now excellently constructed; they are very light and rigid; the focus can be obtained with great precision and ease by means of a screw movement.

THE LENS.—GENERAL REMARKS.—It is a mistaken economy to purchase cheap and inferior lenses: if photography be worth doing at all, it is certainly worth while to do it well. A good lens is the photographer's *sine quâ non.* The double combination is used for portraits, and in all cases where great rapidity of action is desirable. These lenses do not cover a large surface, but the size of the picture may be increased, if the time of exposure is immaterial, by making use of smaller stops, even to the size of half an inch in diameter. At times, such an arrangement with the double lens is useful. A lens which covers six by five inches can thus be made to give a picture sharp to the edges eight by six inches, or even more. Reduced copies of oil paintings are advantageously made with a double lens and small stop.

The triplet lens is now used for landscapes, and copying still objects and works of art generally. It is furnished with different stops; when the object to be taken is well lighted, the smallest may be employed; but for masses of dark foliage, &c., the larger stop should be made use of. A little observation and exercise of judgment will soon determine

the operator in the use of his stops. The rack and pinion movement to the portrait lens is desirable, as it can be readily reached with the hand, for the purpose of getting the sharpest focus. I consider that this addition to the landscape lens is unnecessary, owing to its greater focal length, which makes the rack and pinion movement inconvenient to use. A perfect focus can always be obtained with a well-made sliding camera. Portraits and groups can also be taken in the open air with the triplet, in a good light.

It may not be out of place to conclude with a few general remarks worthy of consideration when absolutely perfect negatives are desired:—The sliding body of the camera should undoubtedly be lined with black cotton or silk velvet. I prefer the latter, the black dye of silk being more permanent. Landscape lenses, under very many circumstances, should be protected as much as possible from reflected light, entering the tube of brasswork, by means of a shade over the upper portion of the tube; this helps to prevent solarization of the sky. The shade need not project beyond four inches; a piece of brown paper and string answer the purpose.

To prove the necessity for this precaution, focus a landscape, withdraw the ground-glass, throw the velvet over your head, and look into the camera. A considerable quantity of light will be perceived on the lower surface of the lens tube; place a shade over the upper portion of the tube, and the extraneous light will vanish. All rays of light that do not actually emanate from the object to be copied ought to be dispensed with, when brilliancy of image is aimed at. It cannot be too frequently urged that the velvet cloth must be thrown over the slide when in position, before pulling up the shutter; and also that this should

be large enough to extend somewhat over the rigid portion of the camera, in order to prevent light entering the sliding body.

I would remark, in conclusion, that experiments with ordinary double lenses of short focal length are, comparatively speaking, worthless for testing the actual value of photographic preparations or processes; the results obtained on small plates are also not sufficiently conclusive. In order to arrive at a full and satisfactory conclusion, when working either for the purpose of chemical investigation in photography, or with a view of establishing the value of any process, plates not less than 10 by 8 inches should be used, and a single lens of ordinary focal length, with not more than half an inch aperture. I have for some time past adopted this course, and have found in every respect the indications more valuable and instructive.

I would say to all who appreciate this art for its great usefulness and numberless appliances, don't be contented with any but the best results; the practised eye soon gets accustomed to detect flaws and imperfections, arising in some instances from the use of bad tools. The connoisseur in photographic matters has now become fastidious, and ceases to admire a photograph for the interest attached to its wonderful production; apart from this, in the advanced and perfected state of the art, correct drawing and pleasing realizations of natural objects are looked for; and surely we may expect, that after twenty years and more of up-hill labor, this young giant of science will stride rapidly onwards, destined, even yet, to take a much higher position as an important and advancing art.

ON THE PREPARATION

OF A

NORMAL NITRATE OF ~~SILVER~~ Hammann BATH.

THE quantity of nitric acid wrapped up in the interstices of crystals of nitrate of silver varies very much, and of course according to the degree of acidity of the solution from which the crystals are formed. My attention has been given to this subject; during my investigations I have found a method of preparing a nitrate of silver bath in the normal state. The process is as follows: It is assumed that all crystals of nitrate of silver contain more or less a small portion of nitric acid; fusing, to get rid of its presence, is a clumsy and objectionable method, for it is difficult to fuse nitrate of silver, even in very small quantities, with a view to perfectly driving off the free nitric acid (for which the crystals have a great attraction), without producing a new decomposition or contamination; the object, therefore, is to render inert this free nitric acid. The alkaline carbonates have been suggested: this method, to my mind, is very objectionable; in the first place, a new compound is introduced, carbonate of silver; secondly, if too much of the alkali be added, the strength of the silver bath is impaired; it is also not unlikely that triple salts are formed. The most simple, and therefore the best plan, and one which I

find answers invariably, whether the bath be old or new, is to add to the prepared silver bath a small quantity of freshly precipitated oxide of silver; the free nitric acid seizes upon this with avidity, and forms at once nitrate of silver (nitrate of silver being a nitrate of oxide of silver); it matters not whether just sufficient of this oxide be added or a large excess; if the latter, the strength of the bath is not impaired, the undissolved excess being simply left upon the filter. Having treated the bath in this way, it is in an alkaline state, and no picture can be taken with it; fortunately, however, its condition is perfectly normal, for the water which dissolves the crystals of nitrate of silver, dissolves also a specific and homœopathic dose of the oxide used—hence the alkaline reaction. It now becomes a nice point to act upon this atom of oxide with nitric acid: in the first place, the excess of undissolved oxide of silver must be separated by filtration, and to the bright filtered solution add ⅘ths of a minim of nitric acid, sp. gr. 1.50 to 200 ozs. of the bath; this quantity is sufficient to correct the alkalinity produced by the presence of oxide of silver dissolved in the water of the bath, and at once, as if by magic, a most perfect picture can now be produced; the sensitiveness of the bath is insured by the known quantity (being minute) of the acid added.

I consider that the presence of this acid, when it can be so nicely calculated as now described, is far less objectionable than the excess of acetic acid sometimes used, this latter being more volatile, and the attraction for nitrate of silver not so strong. The bath, when acetic acid is added to correct the oxide, is liable to change from a possible liberation of this

acid, due to a want of a powerful affinity for silver, which it fails to possess; whereas the nitric acid now recommended, however small the quantity present, is with difficulty got rid of. The object of this paper is, therefore, to establish these facts: 1st. It is best to employ fine and pure crystals of nitrate of silver for preparing the bath; 2d. To get rid of the excess of acid wrapped up in their interstices by adding to the solution sufficient, or an excess of oxide of silver; 3d. That the bath so prepared is in a normal condition; 4th. To render it efficient and in working order, ¼ths of a minim of nitric acid, sp. gr. 1.50, must be added to every 200 ozs. of the filtered nitrate of silver bath to neutralize the oxide dissolved by the water; 5th. It is very evident that, having corrected the nitrate of silver bath with the oxide, the undissolved excess must be filtered away before adding the specified quantity of nitric acid; 6th. I consider that test-papers are not serviceable for indicating a delicately balanced state of the nitrate of silver bath, in which case a developed plate gives the best indication of its condition. I would not for a moment be supposed to ignore the value of test-papers for showing the presence of either acid or alkali when present in a greater quantity than that now referred to.

In this paper I make reference to nitric acid for correcting, sp. gr. 1.50. Acid of this strength is frequently met with in commerce; my object, therefore, in taking this acid as a standard of strength, is sufficiently obvious; first, to show the exceedingly minute quantity necessary to produce the desired effect; and secondly, for the convenience to be derived from making reference to nitric acid of usual strength. It

might, however, appear to many not desirous of taking the trouble to calculate fractions of a drop, that the correction required for 10 or 20 ozs. of the bath must be attended with some trouble. In order to meet this difficulty, I subjoin the following alkali and acid formula:—

THE ALKALI.

Oxide of silver in a moist state.

THE DILUTE ACID.

Nitric Acid 1.50 . . .	6 minims.
Distilled Water	1 oz.

Treat the bath, as described, with the oxide of silver; filter from the excess, and add to each 20 ozs. of this filtered bath, five minims of the dilute nitric acid.

FORMULA

FOR THE PREPARATION OF THE

NITRATE OF SILVER BATH.

INTO a 20 oz. stoppered bottle put
Nitrate of Silver, $1\frac{1}{4}$ ounces,
Distilled Water, 4 ounces—dissolve,
To this solution add
Iodide of Potassium, 4 grains,
Dissolved in 1 drachm of distilled water.

Mix these two solutions; the precipitate (iodide of silver) thus formed is, by shaking, entirely dissolved. Add 16 ounces of distilled water, when the excess of iodide of silver is again thrown down, but in such a finely divided state as to render the saturation of the bath with iodide of silver perfect. Now drop in sufficient of the oxide of silver to turn the turbid yellow solution a dirty brown color; so long as this effect is produced the quantity of oxide of silver, however much in excess, is of no consequence; shake the bottle well for 10 minutes or so at intervals, then add alcohol, 30 minims, and filter; to the filtered solution add dilute nitric acid of the strength stated, 5 minims. The bath is now ready for use, and should be quite neutral.

NOTE.—The above formula has been given for the convenience and instruction of those who may have

to obtain nitrate of silver that has not been specially dried and freed from the excess of nitric acid for photographic purposes; but if the nitrate of silver be pulverized and dried at 212°, the free nitric acid being thereby driven off, the oxide of silver and acid may be omitted.

Formerly, when plain iodized collodion, potassium or cadmium, was used only, in the bath, the oxide of silver and acid could be employed with advantage, at times, as a corrective; but since the introduction of salts of ammonium into collodion, giving rise to the production, in the bath, of nitrate of ammonia, which dissolves oxide of silver, forming with it a triple compound, it has not been found desirable to use this preparation as a doctor for a disordered bath, the remedy in such a case being worse than the disease.

Photographers now generally agree that it is better to set aside a faulty bath rather than waste time in vain attempts at doctoring; but I cannot refrain from stating how, as I was informed, a perfect cure had been effected by a genius, whose perseverance was deserving of all praise, he having tried every known and unknown process with which he was acquainted, or found himself inspired with at the moment, at last, dashed into the refractory solution a lump of cyanide of potassium, an unknown quantity, and as a last resource, added two drachms of the strongest nitric acid to every pint of the solution!! This is merely inserted as a caution, and should be remembered as something to avoid: the perfect cure may be a matter of opinion.

OBSERVATIONS

IN REFERENCE TO THE STATE OF THE

NITRATE OF SILVER BATH,

AND ITS ACTION UPON

COLLODIONIZED PLATES.

THE ALKALINE NORMAL BATH, WHEN FILTERED FROM EXCESS OF OXIDE.—The plate when developed has a grayish color, it is streaky, dirty, and greasy in appearance; the image shows through the film in parts very faintly: *i.e.*, it is only just discernible; the developer flows over the plate very easily.

THE BATH, WITH AN INSUFFICIENT QUANTITY OF NITRIC ACID AS A CORRECTIVE.—The plate when developed gives at first, indications of a perfect picture, but with a suspicion of full exposure; the proper and gradual growth of intensity does not, however, take place; the half-tints in deepest shadow are rendered, and show simultaneously with the high lights; a flat, poor, and feeble image is the result; if the subject be landscape, the sky is faint, transparent, and streaky; the exposure in the camera may have been very short, and under this condition of the bath, perhaps half the legitimate exposure gives the result described.

THE BATH, WITH A PROPER QUANTITY OF NITRIC ACID AS A CORRECTIVE.—The image springs out shortly after the developer is poured on: first, of a well defined metallic gray color, the highest lights being from the first well defined; the growth of middle tints next becomes discernible; the parts in deepest shadow show next in rotation, the whole picture being evident before increase of intensity takes place; this now goes on gradually until an unmistakable harmony pervades the whole; the brilliancy of the picture is well preserved, and no sign of fogging exists. If the exposure has been well timed, there is not much fear of over-development. The intensity of sky is good, and uniformly opaque: when viewed by reflected light, the negative whilst wet presents a soft and partly positive appearance; when dry, this image is more difficult to see, but it should not be too clouded.

THE BATH, WITH AN EXCESS OF NITRIC ACID.—The image appears in parts of the plate only, and that with great difficulty; the black deposit is very transparent; it is altogether most evident that the deoxidizer acts inefficiently, the decomposition of the nitrate of silver being checked by the presence of nitric acid in excess; under these circumstances no amount of exposure in the camera compensates for acidity of the bath; the developer flows with difficulty over the plate.

THE BATH UNDER SOME CIRCUMSTANCES REQUIRES THE ADDITION OF AN ACID.—The indications are, of course, those stated in the second paragraph. In hot weather it is very desirable to add a few drops of the dilute acid to every half-gallon of the bath. I find, also, that when testing and experimenting with collo-

dion *just iodized*, after immersing a dozen plates, a slight alkalinity is evident—to an extent not absolutely injurious—but nevertheless discernible by a falling off in brilliancy of the negative; add a drop of the dilute nitric acid, and all again goes well. No alkalinity is discernible when collodion a day old is employed.

NOTE.—I find it convenient to use a dilute nitric acid, the strength of which has been already given.

DIRECTIONS

FOR

CLEANING THE GLASS PLATE.

It is not at all an uncommon thing to hear that collodion gives spots, stains, streaks, and sundry other cutaneous affections to which "the children of the sun" are said to be peculiarly liable; very much, however, is erroneously, attributed to the collodion, which more properly and with greater justice, should be ascribed to want of cleanliness and method in cleaning the plate. Nothing is so easy; and although there are many ways of arriving at this very desirable end, I unhesitatingly recommend the following as most efficient, safe, and simple. Cleaning the plate is of much greater consequence than some are prepared to admit. Every photographer should make himself thoroughly acquainted with this process; much time, expense, and subsequent labor will be saved by a systematic attention to what may at first be thought sheer drudgery, and which is too often delegated to inexperienced and careless hands. I am not saying too much when I state that, in point of manipulation, cleaning the plate is the key to the whole position. I now proceed to describe, for the benefit of those who can fit up their operating-room with conveniences, the plan I adopt.

I have a shallow sink, three inches deep, lined

with lead, and a pipe to convey away the waste water (the size of this sink must, of course, be regulated by the size of the plates to be cleaned); it is firmly mounted on a stand of convenient height, and securely fixed to the wall of the room; in this sink I place two blocks of deal (1½ inch stuff) a little larger than the plate, covered with thick felt strained over one side of the block and nailed to the edges all round; over this, in the same manner, I strain white calico; the blocks are now prepared, and present a firm but sufficiently soft surface, on which to cleanse the plates; place them in the sink and wedge up tight with loose wedges. I use one of these blocks for the first operation. Place the plate to be cleaned in the centre of the block, and pour on to it a small quantity of the following mixture:—

Prepared Tripoli	2 ozs.
Water	3½ "
Spirits of Wine	4 "
Solution of Ammonia . . .	½ "

Take a tuft of cotton-wool and rub the plate well and firmly over with the above mixture for a minute or so; then remove the plate to block No. 2 (over this I have fixed a tap of water, a few inches above the plate); turn on a gentle stream and rub off the tripoli mixture with a second tuft of cotton-wool. Keep these tufts upon their respective blocks; they are then always ready for use. Be very careful to rub the edges of the glass with the tuft, to remove particles of tripoli which become attached to the roughened edge, and which, if not removed, will give a prolific crop of spots on the picture. Having washed off the tripoli, plunge the plate into a deep dish of

water, and there let it remain until six plates or more have been in like manner cleaned; then take each out singly, again wiping the edges with a tuft of cotton, and pass each plate through a dish of distilled water. Do not set up more than six at a time to drain; when six have been thus treated, commence drying off the first set up. The plates must not be allowed to become dry before rubbing with the cloths. In order to dry them quickly and effectively, place upon the table a piece of felt or ironing-blanket, over which spread one of the cloths (washed in clean water without soap); place the plate upon this, and rub it well on both sides with another cloth doubled up so as to form a pad. One side of this plate should be marked with a diamond, and upon this marked side the greatest care should be bestowed. The plates, so far cleaned, may be stowed away in a box; before use, however, the final rub must be given, to remove all superfluous moisture; this is best effected by two wash-leathers, previously purified by washing and rinsing them freely in water, for two days or so; they must be allowed to dry spontaneously. Lay the plate upon one of these leathers, and rub it well on both sides with the other leather doubled up so as to form a pad. Breathe occasionally upon the plate whilst rubbing; this tends to equalize the moisture. Rub, lastly, with a well-washed silk handkerchief. Even now, some small particles of fibre may be left from the cloths, and these attach themselves very tenaciously to the glass; in order, therefore, to remove these enemies to an absolutely pure plate free from "comets," I take a flat and broad camel-hair brush two inches wide, and pass it firmly over the plate just

before pouring on the collodion. This brush must be most carefully prepared for the purpose, by soaking it in water for two or three days, and rubbing out all dust and extraneous matter with the fingers; it must then be suffered to dry spontaneously, and kept free from dust in a card-board box; if this cleansing be neglected, more impurities will be added to the plate than removed from it.

I have been at some pains to describe clearly a systematic method of plate-cleaning, feeling certain that the necessity for carefulness in this process is not sufficiently attended to. I am sure that nearly all "comets" and other abominations arise from the imperfect removal of fluff and fibre from the plate. These minute particles are not seen until draining off the collodion: they then show themselves in the form of nuclei, checking the collodion in its course, and, what is very much to be avoided, they contaminate the collodion, which becomes full of floating particles, and thus prevents the possibility of getting clean plates, until the collodion has again been allowed to settle; if, therefore, it is required to make experiments only, without regard to the purity of the result, keep a bottle of collodion for this purpose.

When working at home with all the conveniences described at hand, plates used (if the picture is not approved of) may be at once placed in a dish of water; the film then floats off and carries with it all impurities; rubbing with plain tripoli and water and drying as described, will then be found sufficient. New plates must always be put through the whole process, and also those which have become dry with films on.

A perfectly clean glass shows little or no irregularity on the surface when breathed upon, having then, very much the appearance of ground glass, and if properly dried, the moisture flies off rapidly. Collodion flows easily and freely over a well-cleaned and dry plate, presenting a surface free from irregularities, either before or after the action of the nitrate of silver bath.

The practice of cleaning glass plates with detergents, said not to require subsequent washing, is one fraught with great risk and full of objection; it is impossible to get rid of fixed alkalies or salts by mere friction with a cloth without washing. I allude to this method of cleaning (?) because I know that it has been a cause of much trouble to many who have for a time adopted the plan; moreover, it is *by such a process* impossible to remove the tripoli from the ground edges of the glass.

HOW TO

VARNISH THE NEGATIVE.

This subject is deserving of careful attention; at the same time, all that can or need be said concerning it, may be stated very plainly and in a few words.

I will endeavor to explain and comment upon the two methods now in use, and will distinguish them by the terms "hot" and "cold." I apply the first term, hot, to the process making the warming of the plate necessary previous to pouring on the varnish, which is applied whilst the plate is still warm. This method is very generally followed, notwithstanding the inconvenience of heating the plate—for the reason that the coating left upon the surface, is perhaps harder, than when cold varnish is applied, and consequently stands a greater amount of rough treatment: no doubt a desideratum. Ordinary spirit varnish, whether French or English, contains a certain amount of water; that is to say, the spirit generally used is not absolute. A more fluid, and consequently a better varnish, can, I think, be made with absolute alcohol—at least, such is the result of my experiments; but whatever strength of spirit is used, the effect of all spirit varnishes, more or less, is to interpose between the image on the surface of the negative, and the prepared surface of the paper, a layer of gum more or less thick. I need hardly say that any intermediate film

must prevent absolute contact of these surfaces, and consequently detract somewhat from the sharpness of the picture.

There can be no very great mystery as to the composition of spirit varnishes, when it is considered that the gums we have to select from are not numerous, viz., copal, animi, sandarac, thus, mastic, lac, and dammar; these gum resins have, however, various properties, some being harder and more vitreous than the others, whilst some are sticky and resinous. It is, therefore, very desirable to make use of both these qualities, by selecting and combining judiciously such of the gums, just enumerated, as shall give a varnish possessing hardness and durability, with sufficient elasticity. The hardest gum cannot be used alone, but must be mixed with others more resinous. I find that a mixture of the three first on my list answers the conditions just laid down, if absolute alcohol with a small percentage of chloroform is used for the solvent. This varnish has proved, in my hands, the best of the spirit varnishes. I have heard it remarked that this, and no doubt other strong spirit varnishes, occasionally have a very unhappy property of removing the image from the negative; I must say that I have never been able to produce this undesirable result myself, and think that perhaps such an action may have been due either to moisture in the film, unequal application of heat to the plate, imperfect washing-out of the Hyposulphite of Soda or Cyanide, or to some rottenness or peculiar condition of the film of Collodion. The advantage and disadvantages in the use of spirit varnish may be briefly stated: in its favor, a greater hardness of coating; against it, the inconvenience of having to

heat the plate, and loss of sharpness in the positive from the interposed film of gums left upon the surface of the negative. Having disposed of what I have termed the hot process, it only remains to draw attention to that designated "cold." It is not my intention to enumerate the various solvents and gums which are or might be used for the manufacture of cold varnishes. I have tried many of them, and find that all are, more or less, tacky when dry.

I shall confine myself to a few words descriptive of the best cold varnish, which, unquestionably, is that made by dissolving amber in chloroform. Many will be surprised to hear that such a thing as a package of fine amber seldom, if ever, finds its way to this country; but plenty of a very inferior and rough description is to be met with. The finest kind is used for making the mouth-pieces of pipes, which are, I am given to understand, of foreign manufacture. Having learnt this much, I set to work to obtain, through my drug merchants, some further information on the subject, and was fortunate enough to find out the holder of a large quantity of the chippings, from the fine pieces of amber, which he had been provident enough to store away. This is not a coarse powder of amber, but unmistakable chippings cut as with a sharp instrument, bright and clear in quality, in every respect equal, for making varnish, to the fine and most costly pieces, of which, indeed, these chippings are a portion. With such a sample as this there is no difficulty in producing a varnish in every respect desirable for photographic use, and sufficiently hard to withstand any friction that the surface of a negative is likely to meet with. The coating left upon the negative is perfect, and can hardly be distin-

guished from the patent plate: this varnish penetrates the film, and adds very much to the beauty and clearness of the negative, at the same time leaving upon the film the thinnest possible coating, thus admitting of the most perfect contact with the excited paper.

I have had opportunities of examining some hundreds of negatives, produced by various operators, both amateur and professional, many of which were more or less disfigured, if not damaged, by the varnishing operation. My method of using the amber varnish is as follows: I invariably make use of a little distilled water, with which I wash finally the finished negative; this removes the salts of lime that exist, more or less with other impurities, in all waters, in quantities quite sufficient to prevent the formation of a brilliant surface. I consider this simple but cleanly operation one of the important photographic "insect cares." Now set the negative up to drain and dry spontaneously, its face to the wall, and its lower part resting upon a slip of clean bibulous paper; it is as well to change this slip of paper once or twice: when surface-dry, the negatives may be put into a grooved box to keep them from dust, and if more convenient, they may be varnished next day. All varnishes should be applied in a dry room.* Attach the back of the negative to a pneumatic holder kept for the purpose, and having poured into a glass measure more of the varnish than is required to cover the plate, proceed to pour on as much as the plate will hold; keep the plate as horizontal as possible, and let the varnish soak well in for twenty or thirty seconds; then gently

* Just before varnishing, pass the back of the plate over the flame of a lamp, to drive off any moisture; when amber varnish is used, allow the plate to cool before pouring on the varnish.

raise the plate and pour back into the measure the excess, from the nearest right-hand corner. The varnish must not be dashed off, but the plate very gently elevated, at first only just out of the horizontal, and very gradually raised until it stands vertically on the edge of the measure; in this position let it remain a few seconds; on no account rock or give it any eccentric motion, and during the whole operation hold the breath, or turn the head away from the plate to breathe.

Always have two bottles for varnishing—the one to contain the stock of bright filtered varnish, the other to receive the portion poured back into the measure from the plate; when sufficient has been collected in this bottle, filter it through paper into the bright stock bottle. Both amber and spirit varnishes filter rapidly and with a very slight loss. The measure used should not be washed out, but kept turned down and free from dust; it is then always ready for the purpose required.

I possess a negative portrait of Sir John Herschel, taken about ten years ago, which I value very much. This plate was varnished with some varnish made of very fine amber; it does not show the slightest sign of decay, is, indeed, harder than when first varnished. I have also negatives kept under various circumstances of damp and heat for twelve years, and still perfect.

NOTE.—I have occasionally been asked to account for cracks in negatives; fortunately this complaint is not of common occurrence, and therefore indicates an exceptional condition of the film. I have been at some pains to collect all the *reliable* information on this subject from those who have a large stock of

negatives, some of which were varnished five years or more ago. From the facts collected, I have no hesitation in saying that all cracks in negatives arise from want of attention to the following points, viz., drying the negative, washing out the hyposulphite or cyanide, and lastly, the mode of drying the plate before varnishing.* I have before said that negatives should be allowed to dry *spontaneously*. It is of the utmost consequence, as regards the permanency of the negative, that the fixing agent should be thoroughly removed; also, that the heat required to warm the plate before varnishing should be applied in a regular manner, and only just sufficient to accomplish the object in view. When these three points are attended to, negatives will remain intact and free from cracks (as far as my own experience goes) for an indefinite time. Now, with reference to the first point, I say, let the film dry spontaneously, because there may be some conditions of a collodion film, presenting a proneness to split up on the sudden and irregular application of heat to it, whilst still in a wet state: recollect that the edges of the glass plate are usually ground; this restrains a natural tendency of the film to contract after removal of the iodide of silver by the fixing agent; the film is therefore more or less in a state of tension, being extended, so to speak, by the ground edges of the glass. This simple operation of passing a cloth (the thumb-nail being inserted) round the edges of the negative, to the distance of one-eighth

* Negatives should not be kept in damp and cold rooms; no matter how carefully they may have been washed and dried, or how good the varnish may be, if exposed to frost and moisture, symptoms of cracks will be soon evident. I have known instances of negatives becoming cracked in the film, from exposure in the printing-frame for some hours on wet and cold days in winter.

of an inch, sets the film free, removes the thick dirty edge of the negative, and is a safeguard against injury arising from continued tension of the film; moreover, it adds to the neat appearance of the negative, and admits of the film being overlapped with the varnish—an additional advantage. The reason for scrupulous attention to my second point is sufficiently obvious: a slight trace of cyanide or hyposulphite might not show itself at first—sooner or later this wrapped-up element of decay will begin to make itself known, and brings about a disintegration of the film. An impression has got abroad that cyanide of potassium requires for its removal less washing than the hyposulphite of soda. I think this is erroneous: my opinion is, that the former salt should be as well washed out as the latter, and to effect this I believe that quite as much water is necessary. The collodion film has a very retentive action on most chemical solutions presented to it. I do not see why it should be less an absorbent of the cyanide than the cuticle of the body. I take this as a familiar illustration, because most people must have observed, that when the fingers have been cleaned with cyanide of potassium, the peculiarly disagreeable odor remains for a time, even after the most perfect ablution. Lastly, the instructions already given sufficiently explain the manner of warming a negative previous to varnishing. Varnishes will be selected by the photographic artist for qualities especially adapted to photographic use, viz., facility of application, hardness of film, and absence of tackiness. These conditions are well fulfilled in the preparations spoken of in my paper "How to varnish the negative."

HOW TO

PRINT FROM THE NEGATIVE.

In order to print from the negative, very little skill in manipulation is necessary; but very much judgment and taste must be exercised in order to produce the best results, if really good proofs are cared for. Many look upon the operation of printing as mere drudgery—beneath notice; this work is frequently handed over to the care of boys and girls, who have as much feeling for art as the pressure-frame used to produce the picture. Having a first-rate negative, it is quite possible to obtain from it proofs of various qualities; so that, it may be, there are not two alike in a dozen prints, and perhaps one of them will be found superior to the other eleven. I admit that a difficulty exists, and one not easily removed; it lies solely in the variability of sunlight in this climate. At first sight it would appear easy enough to obviate this by a watchful examination of the picture whilst printing; such a course gives a proximate notion only of the real state of the print; for, presuming the day be dull, and occasional glimpses of sunshine flit over the printing-frame, it will be found impossible to calculate to a degree, the amount of reduction that will take place in fixing the picture. If exposed for some time on a dull day without sun, the positive may appear to be very much overdone, and yet be too much acted upon whilst undergoing

the necessary immersion in the bath of hyposulphite of soda, *in consequence of the greater reducing power of this salt on proofs printed in feeble light.*

I am, of course, taking for granted that there is a shade of intensity to be sought for in the positive picture, which the negative is capable of giving, and which shade shall be acknowledged to be that best suited to the particular subject represented. For the reasons just stated, it will be found difficult to obtain this quality at will with a variable sunlight. The natural deduction to be drawn from these remarks, therefore is, that in order to produce from a negative several copies uniform in quality, it is necessary to print in direct sunlight; one or two experiments will then show the character of the negative; the time required to print from it, in order to obtain a special intensity of tone, can be easily noted. I do not now refer to color; but, by intensity of tone, I mean that amount of force giving artistically the best result from a particular negative; and this leads me to another remark, viz., the quality of the negative; for, supposing the same collodion to have been used for the production of a series of negatives of different subjects, the printing peculiarities of each negative will vary, according to the subject represented, the color of which, and quality of the light used to produce the negative, affect its resisting power to stop out rays of transmitted light. It is therefore necessary to be acquainted with the peculiarities of each negative. There is this advantage in printing in direct sunlight—the subsequent reduction can be calculated to a nicety, whether the negative be faint or vigorous; for, as I have before stated, the positive produced under these circumstances does not suffer

such an excessive and variable reduction in the hyposulphite of soda, as when a bad or variable light is used. I am, of course, aware that some sort of compromise may be effected by very much over-printing, and then reducing the excess of intensity by a prolonged immersion in the hyposulphite of soda bath. I am by no means satisfied with this plan; the picture then is not of first-rate quality, but hard and inferior in tone, and seldom brilliant. Of course, in allowing for the over-printing, it is necessary to lay down a given time for fixing in hyposulphite of soda; I put this at half an hour, and never fix more than a few proofs in a dish at a time. Now it can be very readily demonstrated that positives printed in a bad light are much more rapidly acted upon by the hyposulphite of soda, as I have before said; nothing, therefore, seems so easy of confirmation as this proposition, that in proportion to the acting power of the hyposulphite of soda upon the reduced silver, so will be the action of other external influences of a chemical nature on the picture when finished. To my mind this appears only a plain, common-sense view of the case, and the inference to be drawn therefore is, that a greater general permanency is obtained by printing in direct sunlight. These observations may open up a new field of inquiry, and may, perhaps, account for the variableness in the permanency of photographic pictures. All good negatives should stand sunlight printing: I am certain that a finer definition of detail is obtained, and both a greater richness and brilliancy of color, when prints are made under these circumstances.

I may as well remark here, that a very faint

negative will, under no conditions of light, give a fine, rich, and dark-colored positive; the picture may certainly be cooked in baths of gold and much variety of smudginess produced—a dead, cold, and leaden hue—shades of black fit only to represent scenes in pandemonium. This is the character of color forced upon faint positives by over-dosing with gold. A well-printed positive of good vigorous color will stand a longer immersion in the gold bath, and yet be free from the objectionable color just described. There is considerable room for display of taste in the selection of shades and tones of color in photographs, according to the subject represented; the most infelicitous choice is sometimes made. I think that a great deal of the evil is to be attributed to the wholesale and reckless use of gold, which, if skilfully used, is capable of producing every variety of good photographic color.

I once heard of an amateur who apologized to his friend for the bad color of a photograph he was anxious to present him with, at the same time saying, somewhat mournfully, "he had expended on it the contents of a 15-grain bottle of gold;" but even then it fell short of some ideal standard of perfection. The doctrine of sunlight-printing which I have endeavored to lay down would, of course, be fatal to general photographic business in this country; it would never do to be waiting upon and otherwise dodging our great luminary; the principle involved, however, may nevertheless be true, although its practice may be difficult or perhaps impossible. I am now addressing the few who, like myself, are anxious to produce at will, a first-rate impression from a negative of good quality.

There are several good toning processes; I prefer the simple Alkaline Chloride of Gold process, to which a preference is also given by some of our most successful photographers. Albumenized Paper, either Saxe or Rive, may be used; with the latter a darker color is obtainable. Float each piece of paper for three minutes upon a solution of nitrate of silver, 60 grains to 1 ounce of distilled water, and use it as soon as it is quite dry. I have observed that a brighter color is obtained, when the paper is used very soon after excitation; let the paper, however, be quite dry before using it; expose in the frame in the usual way. I prefer, for my own use, the bars of pressure-frames fitted with screws—the contact may then be made so perfect all over; but spring-back pressure-frames are generally used by photographers, and they can now be obtained of excellent quality. In sunlight the time of exposure will vary from ten minutes (the minimum time) to half an hour for ordinary subjects; but a much longer exposure will be necessary for the representation of black and white subjects, such as engravings. Be very careful to examine the print *in yellow light*, whilst printing: if the frame be opened, even for a few seconds in sunlight, a slight general action of light will take place over the whole surface of the picture. Conduct the operations of toning and fixing in yellow light. When the print has reached the proper intensity (allowing for the reduction), remove it from the printing-frame, and wash away in several changes of common water, all the nitrate of silver; when this has been properly effected, prepare the following bath, which will be ready for use an hour after mixing:—

Solution of Bicarbonate of Soda, 40 minims.
(Strength, 8 grains to 1 oz. of distilled water.)
Solution of Chloride of Gold, 20 minims.
(Strength, 15 grains to 5 drachms of distilled water.)
Distilled Water, 4 ozs.—Mix.

The solutions both of gold and soda may be kept ready for use in separate bottles. I throw away the coloring bath after use, or it may be set aside for the purpose of recovering the Gold, when a sufficient quantity has been accumulated. The above quantity will tone half a dozen pictures 10 × 8, if warm tones only are required; the time of immersion varies from thirty seconds to two minutes. Over-color the positives slightly, to allow for subsequent reduction in the hyposulphate of soda bath. Now wash away the excess of gold solution rapidly in two or three changes of water, and fix the proofs in a bath of hyposulphite of soda, 1 oz. to 6 ozs. of water. In order to make sure of the pictures being perfectly fixed, let the proofs remain in this bath half an hour—not less, moving them about occasionally; then wash in running water for twelve hours, and let them dry spontaneously. I have a strong feeling in favor of a particular color for photographs; no word-painting will describe this or any other tone of color; I shall be happy, however, to show to any one, specimens of coloring by the above formula. It is very evident that paper treated and washed as just described, involving an immersion of twelve hours in liquids, must have undergone some alteration in the arrangement of its atoms; these are now, of course, more open, spongy, and porous, consequently the particles of silver forming the image must of necessity be somewhat divided and less compact than is desirable;

I think, therefore, more in a condition to absorb deleterious gases, and more susceptible of damage from moisture in the atmosphere or other injurious influences. It is most desirable to restore the paper to its original condition; this is easily done at a very small charge by the hot presser. The pictures must not be over-rolled—such an action would be injurious to the surface. I order mine to be rolled flat only; this last operation is, I consider, most beneficial, both as regards the beauty and permanency of the finished photograph.

I cannot conclude this paper, without stating that it was written previous to the use of iron as a developer, and consequently, had special reference to printing from a class of negatives, not so frequently seen now a days. I have also to remark that, as a rule, printing is now generally performed in the shade by all professional photographers, this plan being found practically to give the most uniform results, and admitting of a greater latitude in the time of exposure in the printing-frame; but notwithstanding this, the principle I have endeavored to enunciate applies with equal force and truth, to the production of prints from any kind of negative whatever; although, as I have before stated, printing by sunlight could not be carried out with any chance of commercial success. I republish the paper, feeling sure that it will be read with interest by those who print only for amusement, and are anxious about the permanency of their pictures.

THE CAUSE OF

FOG, STAINS AND STREAKS

IN THE

COLLODION NEGATIVE.

FOGGING of the plate or a general haziness of the image, may be due to several causes; it may be produced by the action of light in the camera. All things considered, is it not wonderful that we have a clear image in a latent state upon the highly sensitive surface of the collodion plate? Light passes equally into the darkened box through the full aperture of the lens; but at the focus of the lens it is also deposited, so to speak, in a ratio equal to the reflecting power of the surfaces of the objects to be copied, impressing the first atoms of the sensitive film, in a degree equal to the amount of light, projected from the bodies to be represented. It will be readily granted and very easily conceived, how soon a disturbing influence may be brought about, by the introduction of any false light in the camera wherein this image is produced; but, notwithstanding this incontrovertible fact, there are those who remain careless as to the manner of rendering the camera absolutely dark, inattention to which, prevents brilliancy of the image, producing what is termed fog. The indistinctness referred to, may also be produced by sensitizing and developing the plate in a room lighted either by

means of light, improper in quality, or by using too much of this light. What, therefore, is the character and amount of light that can be safely used in the operating room? In reply to this inquiry there is fortunately a very clear answer; let me state it. And first I wish to lay down as a rule, that with properly prepared collodion, no matter what the light out-of-doors be, the negative image, whether under-exposed, or just enough exposed, should more or less, on some portions, and generally of course on those parts in deepest shadow, show a bright positive surface, when developed and fixed. Too much light in the operating room will destroy this brilliancy. Another guide is the behavior of the developer. The developer should remain bright for some time; too much light in the room will cause it to blacken, and in some cases throw down a loose black deposit at a very early stage of the development; I recommend every one to adopt the course I am now going to suggest. Darken the room entirely, so that no object be discernible; slits, crevices, and holes will then be seen. Now let light into the room, passed through a piece of amber-colored glass, covered closely on each side with a single thickness of yellow tammy. For the purpose of experiment only, let this aperture of yellow light be as small as possible; under these inconvenient conditions of light, develop a picture, and note well its character; then find out by degrees how much larger the aperture of yellow light may be made, so that the beauty and purity of the picture be not less on comparison with the first result, obtained almost in darkness, and which may be called, the test plate. It will then be very soon ascertained how large the aperture of yellow light may be made with safety. Let it be,

however, remembered that this experiment must be performed on a bright day, when the light is strongest upon the covered yellow glass. I do not believe that either yellow glass or dyed stuffs *alone* can be depended on; the perfection of a yellow light for photographic purposes will be found in a combination of these two substances. The number of superficial square inches of light, passing through this medium, must be regulated according to the position of the window through which the light passes; hence the necessity for these experiments, and the difficulty in laying down any fixed rules. This is my formula for lighting a room with yellow light; but bear in mind that the want of a perfectly light-tight cover to the bath for use, whilst the plate is iodizing, would be equally a source of stains and fogging; therefore, in making the *test* experiment, cover the bath and its case entirely over with black velvet or some other dark material, should there be occasion to open the door during the preparation of the plate. The window of the room should also be fitted with a moveable shade of yellow material, in case the sun's rays should at some hour of the day fall too strongly upon it. An extensive correspondence confirms me in the opinion, that many suffer from a want of knowledge of the deleterious action of light, under the circumstances stated.

Again, the Collodion may be the cause of fog. The absorption of Iodine that takes place, more or less, in Collodion containing a Bromide, renders it too neutral, frequently giving rise to a haziness of the image, and consequently, an impression that the Nitrate of Silver Bath is out of order is frequently conveyed, when such is really not the case.

When Collodion becomes colorless or lighter in color, after having been kept a few days iodized, a solution of Iodine in Spirit should be added, in quantity just sufficient, to restore the pale amber color which it possessed when freshly iodized.

A bright picture is always obtainable with properly prepared Collodion, *when used of the proper color*, according to these instructions; it therefore follows, that when fogging occurs, it must be due either to the deteriorated state of the bath, or to causes stated in this paper, viz., improper lighting of the subject, or to extraneous light either impinging on the lens, or entering the operating room in improper quality and quantity.

An under-exposed picture is the best test for the condition of the chemicals (*i. e.*, as to freedom from fog. The image in parts, when under-exposed, should be, when viewed by transmitted light, as clear and bright as the glass, and more or less positive by reflected light. No more Iodine should be added to Collodion than is necessary to produce this result. The addition of acid to the bath should be avoided, as this tends to impair the quality of the negative, lessening sensitiveness and density.

The atom of Iodine recommended, develops Nitric Acid, and insures its presence in proper quantity, and, moreover, in the proper place, being first liberated in the body of the film of Collodion, thus giving the greatest amount of brilliancy combined with the maximum of sensitiveness.

Formula for Solution of Iodine:—

Iodine	2 grains.
Spirits of Wine	1 drachm.

One drop added to each ounce of Iodized Collodion will be found to produce the desired effect.

It may sometimes be necessary, after a few days, to repeat the dose.

N.B.—The above remarks apply also to Collodion sold Iodized, which, if colorless, should be rendered pale yellow by the addition of Solution of Iodine as above directed.

Glass may be viewed as a chemical compound, the silica, of which it is composed, combines with the alkaline bases, soda and potash, in definite proportions. Like other chemical bodies it is affected by atmospheric influences—the harder the glass the less it is altered by moisture and chemical agents, a soda glass being preferable to that made with potash. Although silica unites definitely and in equivalent proportions with the alkaline base, a variable quantity of the basic oxide is found to exist in most glass, hence the difference in hardness and hygrometric properties. Bearing these facts in mind, it is easy to understand the necessity for attention to the condition, not only of the surfaces, but also of the body of the glass at the time it receives the collodion solution; to insure a dry condition it must be well rubbed in winter, on both sides with dry or warm cloths. I find nothing better than the mixture recommended in this pamphlet for obtaining a clean and uniform surface. I can always produce a faultless negative when the plate has gone through the process referred to.

Now it will be very easily seen how moisture operates in producing streaky or stainy pictures; if the operator adds a drop or so of his collodion to a small quantity of water in a measure, the incom-

patibility of the two fluids is very evident, and no amount of agitation will produce solution or mixture.

It is, however, quite true that a drop or two of water added to collodion, becomes taken up by shaking; in the case of the moist plate we have an illustration of the first example, viz., the collodion to the moisture; or if it be thought, that the excess of collodion in this case favors the absorption of moisture presented to it, as in the second example, recollect that the operations are not analogous, for the necessary agitation is wanting, and hence a cause of the streaky and smeary appearance resulting from the contact of bodies having no affinity for each other. The effect of moisture or water when brought into contact with collodion is to precipitate the pyroxyline held in solution; a streaky condition of the plate is thus produced, and in consequence, these parts absorb the nitrate of silver unequally.

Secondly, a too rapid immersion of the plate will produce a similar result. In winter or in damp weather the film does not set rapidly, a few seconds should then be allowed to elapse before immersing the plate; when the thermometer is at about 60° the plate may be placed in the bath soon after the collodion ceases to run, without any fear of producing streaks; perform this operation leisurely and watch the appearance of the film at that corner nearest the bottle.

Thirdly, an excessive accumulation of ether and alcohol in the bath. The bath in time becomes contaminated with ether and alcohol (ether being only miscible with water in a certain proportion) especially, so in winter, the ether and alcohol in damp and cold weather not leaving the film so freely. The excess of

ether floats on the surface of the bath in a greasy condition, combined with some organic matter from the film: this impurity is not readily separated by filtering the bath through paper, the greater portion passing through the filter; it may, to a certain extent, be got rid of, by lightly passing a slip of filtering paper over the surface of the bath, by which the greasy matter is absorbed. This plan is, however, troublesome and requires repetition; exposure of the bath for some days, in a wide-mouth bottle, to light. and heat, shaking up with it at the same time a little carbonate of soda, will frequently again render the bath workable.

A better plan is, to make use of a stoppered glass bottle with a glass tap inserted about an inch or so from the bottom, by means of which, the intermediate bright solution is drawn off for use, and all floating matter avoided; this arrangement has the further advantage of leaving all particles of detached pieces of film and iodide, at the bottom of the vessel, and does away with the inconvenience of having to filter the bath so frequently. The bottles here described can be procured to hold from four to sixteen pints, and are most useful for all chemical solutions.

Fourthly, from floating particles of film and iodide in the bath which having been acted upon by light are in a catalytic condition, and, becoming attached to the film, assist in intensifying the action along the stream of liquid flowing from this nucleus. In these suggestions I think will be found means for overcoming and providing against streaks: there is, however, another enemy to absolutely clean and perfect plates —I allude to the innumerable varieties of spots, met with more or less at times by even the most accom-

plished photographers. I do not think that these arise frequently from dust; I have worked occasionally in a most dusty room, and still dustier camera, without a speck on the negative. Presuming that the collodion be of good quality, my own experience in this matter points to one special cause, and one only, providing the remarks on this subject in my paper, "How to Clean the Glass Plate," be borne in mind; they arise chiefly from the breaking or rather grinding-up of the film of iodide, by means of the stopper inserted into the neck of the bottle, after the preparation of the plate; the film is not easily removed by wiping, for this act often fails to remove the dried film, a portion of which becomes only displaced and falls undissolved into the collodion. The remedy at once suggests itself—work without a stopper; this may be easily done at home, but not so out of doors; for home use, a bottle with a cap only, can be used, but the bottle should be provided also with a stopper to insert after work, the neck to be wiped clean before replacing it. When working out of doors, perfectly clean pictures can always be insured, by first pouring away a few drops of the collodion, and then proceeding at once to coat the plate; this latter plan can also be adopted with advantage, even when the capped and stopperless bottle is employed.

APPENDIX.

FORMULA FOR GOLD TONING BATH WITH ACETATE OF SODA.

Chloride of Gold	3 grains
Acetate of Soda	1 drachm
Water	20 ounces.

This bath should be prepared twenty-four hours before it is required for use; it keeps well, and only needs strengthening from time to time with more of a freshly made solution.

FORMULA FOR GOLD TONING BATH WITH CHLORIDE OF LIME.

Chloride of Gold	3 grains
" Lime	2 grains
Water	20 ounces.

Very dark tones are easily obtained with this bath; it must, however, be prepared some days before it is required for use; if made with boiling water it may be used the following day.

FORMULA FOR AMMONIO-SULPHATE OF IRON DEVELOPER.

Ammonio-Sulphate of Iron . .	25 grains
Glacial Acetic Acid	15 minims
Alcohol	½ drachm
Water	1 ounce.

A preference is given by some to the above formula.

MR. CAREY LEA'S DEVELOPER.

I give the formula for this new developer with Mr. Lea's remarks thereon, in his own words:—

"It has seemed to me probable that if an organic matter could be chemically combined with an iron developer we might expect to obtain a development uniting the advantages of an iron and a pyrogallic development—the delicacy and detail of the one, and the force of the other.

"An attempt has already been made in this direction, and not without a share of success. A so-called saccharo-sulphate of iron has been tried, and by some operators liked. But it appears extremely improbable that this developer, as made according to the usual directions given, can contain the sugar in the form of a chemical combination. It has, indeed, been formally asserted that sugar will crystallize with sulphate of iron in any proportion, depending altogether upon the quantity of each that chances to be present. Besides, we know that sulphuric acid is capable of forming a large number of conjugated acids with organic substances, but in every case the organic body must be presented to the free sulphuric acid. In no case does the union of the organic body with the acid take place when the latter has been first combined with a strong base. It is, therefore, I think, pretty clear that the term "saccharo-sulphate," us used in photography, is a complete misnomer. To obtain a true saccharo-sulphate of iron it is essential that the saccharo-sulphuric acid be first formed, and, subsequently, be combined with the iron.

"It seemed to me, therefore, probable that a true sulpho-conjugated salt of protoxide of iron would have great advantages as a developer; and I therefore concluded to make the experiment, using *gelatine* as the organic substance. Follow-

ing out these experiments, I obtained an excellent developer, very manageable, giving all the detail of sulphate of iron, and a strong dark image like that of pyrogallic acid, rarely requiring re-development, and giving light, clean negatives, with singularly little tendency to fog by prolonged use of the developer.

"I shall now proceed to give the mode of preparation of this developer.

"Add an ounce of sulphuric acid to three ounces of water, and set aside to cool. Then add to this liquid an ounce of good gelatine; let it swell and dissolve, placing it for that purpose in a slightly warm place, not exceeding blood heat, for twenty-four hours. Then add iron filings in excess, avoiding all application of heat; let it stand for several days. Finally add a little acetate of soda as before; filter, and dilute to fifteen ounces.

"It is very curious to observe the power which the gelatine exerts as a restraining influence. This developer contains a very large quantity of sulphate of iron, much more so than is usually employed in a developer, and yet it stands in need of no free acid to check it; and the restraining is so effectual that it may be kept on the plate twice as long as a common iron developer without fogging. In this respect, as well as in the color which it gives to the image, it resembles pyrogallic acid.

"I would especially warn those who may prepare this developer for themselves to apply heat only as directed in the formula, and not to any greater extent or degree. If, for example, heat be applied to expedite the solution of the iron, a decomposition appears to set in, and the liquid obtained, though it may still develop, will not possess the good qualities of that prepared strictly in the manner which I have described."

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